REMARKS

Claims 1-6 and 8 are presently pending in the application.

Claim 8 has been added which recites that the elevation angle of the intermediate cylindrical section is 85° or greater. Support for this amendment may be found in the specification at least at page 8, lines 6-9. No new matter has been added by this amendment, and entry is respectfully requested.

The Examiner has rejected claims 1-6 under 35 U.S.C. § 102(b) or under § 103(a) as being anticipated by or obvious over U.S. Patent No. 3,409,542 of Molstedt ("Molstedt"). The Examiner argues that Molstedt discloses a process of discharging and transferring upwardly fluidized particles from a dense fluidized layer forming section to an upper section having a diameter that is smaller than the dense fluidized layer forming section, wherein an intermediate cylindrical section (cone) is provided between the dense fluidized forming section and the upper section. The Examiner estimates that the diameter of the intermediate section is 1/3 to 2/3 times that of the dense fluidized layer forming section and the height of the intermediate section is 1 to 6 times a diameter thereof. Molstedt allegedly teaches that the intermediate section has truncated cone ends connected to the dense fluidized layer forming section and said upper section, respectively, the former having an elevation angle of 60°. The Examiner further argues that Molstedt discloses that the particles have an average size of from 40 to 100 microns, a gas superficial speed for fluidization within the dense bed of 0.3 to 2 ft/sec (0.09 to 0.6 m/sec) and a velocity at the tapered zone of 25 to 100 ft/sec (7.6 to 30.5 m/s). The Examiner points in particular to the Figure, col. 3, line 8 through col. 4, line 9 and col. 5, lines 7-65 of Molstedt.

The Examiner acknowledges that Molstedt does not specifically disclose that the intermediate section is a cylindrical section. However, the Examiner argues that it appears that the intermediate cone section of Molstedt is a special type of cylinder. Therefore, the Examiner contends that the limitation "cylindrical" is taught by the reference. Alternatively, the Examiner contends that it would have been obvious to one having ordinary skill in the art at the time of the invention to have modified the process of Molstedt by using an intermediate cylindrical section as claimed because it would have been expected that, in the process of Molstedt, the results would be the same or similar when using either the claimed section or the Molstedt section because both sections would result in increasing velocity of the gas as it proceeds upwards.

Applicants respectfully traverse these rejections and the arguments in support thereof as follows, and respectfully request reconsideration and withdrawal of the rejections.

As explained in the background section of the present application (see page 7, lines 4-17), in the surface of the dense fluidizing layer in fluid catalytic cracking (FCC) devices, clusters of particles jump from the surface when bubbles rising through the layer rupture. The clusters then break up, and part of the cluster descends and part rises. In a relatively short freeboard (upper space), as in traditional devices, the clusters cannot break up completely, even if the upper portion of the dense fluidizing layer forming section is formed into a truncated cone. Therefore, clusters can pass through the upper portion and reach the high velocity transferring section. As a result, the amount of transferred particles varies and pressure loss occurs.

However, according to the present invention, an apparatus used in a process of discharging and transferring fluidized particles contains an intermediate section formed into a substantially cylindrical shape. The cylindrical section may be a normal cylinder in which the upper and lower portions have the same diameter. Alternatively, as described at page 8, lines 6-12 of the application, the diameter of the lower portion of the cylindrical section may be larger than that of the upper portion or may have an elevation angle of 85° or greater. This design is necessary so that the cluster of particles (catalysts) from the dense fluidizing layer forming section (reactor) fully break up while rising through the cylindrical section. Thus, when they reach the high-velocity transferring section (a riser), they are uniformly dispersed in and rise uniformly with the gas. Therefore, use of the apparatus in the claimed method decreases variations in the quantities of particles to be discharged from the reactor and transferred to the riser, as well as changes of pressure in the riser, making it possible to smoothly and stably transfer the particles through the system without clogging the cyclone separator or the particle down-flow circulating line.

The particular dimensions of the intermediate cylindrical section are also important to the present invention. Specifically, when the diameter of the intermediate cylindrical section is 1/3 to 2/3 times the diameter of the dense fluidizing layer forming section, the gas velocity in the intermediate section is three to six times faster than the gas superficial velocity in the dense fluidizing layer and is sufficient to break up the clusters (page 8, lines 13-22). The height of the cylindrical section is preferably one to six times its diameter, since a shorter section is not tall enough to break up the clusters (so that the particles do not disperse uniformly in the gas), and a

height greater than six times the diameter does not provide any additional benefits and merely increases the size of the apparatus unnecessarily (page 8, last line to page 9, line 8).

In a typical FCC apparatus, there is usually a large difference between the diameters of the riser and the reactor. One skilled in the art would thus be motivated to adopt a truncated cone as an intermediate section, since such a shape would smoothly connect the ends of the reactor and the riser. In fact, as described at col. 5, lines 45-48 of Molstedt, the apparatus of Molstedt uses three successive tapered sections with the included angles being 60°, 30°, and 15° for the lower, middle, and upper cones, respectively. One would not be motivated based on Molstedt to utilize an intermediate section having a substantially cylindrical shape, particularly since there is no teaching or suggestion in Molstedt of the benefits thereof, including increasing the superficial gas velocity, breaking up clusters, and providing decreased variation in particle quantities and pressure increases.

The Examiner argues that the tapered cone of Molstedt is a special type of cylindrical section. However, the maximum elevation angle taught by Molstedt is 60°. Such a tapered cone would have too large a slope; that is, it would not meet the definition of a substantially cylindrical section (having an elevation angle of 85° or greater), as described in the specification at page 8, first paragraph and recited in claim 8. The truncated cone of Molstedt would thus not allow the clusters to break up sufficiently while rising, as in the apparatus according to the invention.

Finally, the Examiner argues that the results of using the claimed intermediate section or the Molstedt section would be the same or similar because both would result in an increased velocity of the gas. Applicants strenuously traverse this conclusion, which is unfounded and incorrect. As described at page 13 of the specification, a comparative example was performed in which the truncated portion of the apparatus (12) was directly connected to the riser (15). That is, no intermediate cylindrical section was included. Using such a modified apparatus, it was found that the pressure change in the riser was 127.4 Pa, compared with an increase of 78.4 Pa when the apparatus according to the invention was utilized, a 1.6-fold increase. Further, the collapse of the clusters rising from the fluidizing layer was insufficient, and most of the clusters thus passed through the truncated portions and reached the riser. It was also observed that bulks of particles in the form of highly-dense vertical stripes were transferred, varying in time. Variation in particle load was observed in the cyclone and the following particle down-flow

circulating line, and clogging occurred frequently. These results demonstrate the importance of the intermediate cylindrical section in the apparatus of the invention. The comparative apparatus, having no intermediate cylindrical section, is similar to the apparatus of Molstedt, thus proving that the Examiner's assertion regarding the similarities between the Molstedt and inventive sections is incorrect. Rather, the results which are observed by the inventive apparatus would not be expected based on a reading of Molstedt or the ordinary skill in the art.

In sum, Molstedt does not teach or suggest all of the claimed elements, such as the claimed intermediate cylindrical section. Furthermore, one skilled in the art would not have been motivated based on Molstedt to adopt the claimed cylindrical section, nor would the beneficial results of using such a section have been expected based on Molstedt. Accordingly, reconsideration and withdrawal of the § 102(b) and § 103(a) rejections are respectfully requested.

In view of the preceding remarks, it is respectfully submitted that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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